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AN 2000:412389 HCAPLUS
DN 133:33391
TI Extremely thin copper alloy **wire** having high strength and its manufacture
IN Ichikawa, Masamitsu; Sawamoto, Takehito; Sugiyama, Shuichi
PA Fujikura Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 4 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI JP 2000169918	A2	20000620	JP 1998-346223	19981204

AB The extremely thin Cu alloy **wire** contains 0.05-2.0% Ag and has tensile strength .gtoreq.35 kg/mm2. A Cu-(0.05-2.0%)Ag alloy **wire** material is drawn at .gtoreq.50% draft and coated with an insulating material under heating at 200-400.degree..

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審査請求　未請求　請求項の数２　ＯＬ　（全　４　頁）　最終頁に続く

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(54)【発明の名称】　極細線及びその製造方法

(57)【要約】
【課題】　本発明は、引張強度が３５ｋｇｆ／ｍｍ２以上の高い強度を有するマグネットワイヤなどとして使用される極細線の製造方法を提供せんとするものである。
【解決手段】　かゝる本発明は、Ａｇ濃度を０．０５～２．０ｗｔ％とし、残部が銅及び不可避的な不純物である銅合金線材に伸線加工率が５０％以上の伸線加工を施し、しかる後、この伸線された銅合金線材に２００～４００℃の加熱下で絶縁材料を塗布し、焼き付ける極細線の製造方法にあり、このＡｇ濃度とこの塗布し、焼き付け時の加熱温度によって、引張強度が３５ｋｇｆ／ｍｍ２　以上の高い強度を有するマグネットワイヤなどとして使用される極細線が得られる。

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【特許請求の範囲】

【請求項１】　Ａｇ濃度を０．０５～２．０ｗｔ％とし、残部がＣｕである銅合金線材からなることを特徴とする極細線。

【請求項２】　Ａｇ濃度を０．０５～２．０ｗｔ％とし、残部がＣｕである銅合金線材に伸線加工率が５０％以上の伸線加工を施し、しかる後、この伸線された銅合金線材に２００～４００℃の加熱下で絶縁材料を塗布し、焼き付けることを特徴とする極細線の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、電子機器などのマグネットワイヤなどとして使用される極細線及びその製造方法に関するものである。

【０００２】

【従来の技術】近年電子機器の小型化、軽量化に伴い、これに使用されるマグネットワイヤ（巻線）も益々細径化が要求されている。しかし、線材の断面積が小さくなるほど線材の破断張力は小さくなる。このため、マグネットワイヤとして用いられる極細線、特に直径（φ）が０．１mm以下のものにあっては、高い引張強度を持つことが要求される。

【０００３】通常、細径のマグネットワイヤとしては、銅線を所定のサイズまで伸線加工した後、種々の絶縁材料を高温で塗布し、焼付けて被覆させた合成エナメル線などが使用されている。

【０００４】一方、銅線は（他の金属線も同様であるが）、伸線加工することにより、加工硬化し、高い引張強度を持つようになる。銅線を電線などの導体として使用する場合には、この伸線加工による特性を利用して、必要な引張強度を得るようにしていることが多い。

【０００５】

【発明が解決しようとする課題】ところが、加工硬化された銅線は、約２００～３００℃の間の温度下におかれると、金属組織が再結晶化して、軟化する特性がある。

【０００６】このため、上記のようにマグネットワイヤとして、銅線を用い、所定のサイズまで伸線加工しも、その後、絶縁材料を高温で塗布し、焼き付けて合成エナメル線などとした場合、通常絶縁材料の塗布、焼き付けは２００℃以上の高温で行う必要があり、この絶縁材料塗布時の高温処理によって、銅線が軟化してしまい、引張強度が低下してしまうという問題があった。

【０００７】本発明は、このような従来の問題点に鑑みてなされたもので、線材の合金組成やその製造方法について種々の検討を行い、導体部の引張強度が３５ｋｇｆ／ｍｍ２　以上の高い強度を有するマグネットワイヤ用などの極細線とその製造方法を提供せんとするものである。

【０００８】

【課題を解決するための手段】請求項１記載の本発明

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は、Ａｇ濃度を０．０５～２．０ｗｔ％とし、残部がＣｕである銅合金線材からなる極細線にある。

【０００９】請求項２記載の本発明は、Ａｇ濃度を０．０５～２．０ｗｔ％とし、残部がＣｕである銅合金線材に伸線加工率が５０％以上の伸線加工を施し、しかる後、この伸線された銅合金線材に２００～４００℃の加熱下で絶縁材料を塗布し、焼き付ける極細線の製造方法にある。

【００１０】

【発明の実施の形態】本発明の極細線では、２００℃以上の高温下で絶縁材料を塗布し、焼き付ける際の高温処理時における線材の軟化を防止するため、銅（Ｃｕ）にＡｇを添加して銅合金線材とし、そのＡｇ濃度を０．０５～２．０ｗｔ％としてある。なお、この銅合金線材中にはＡｇの他に通常工程中に除去しきれない微量の不純物（例えばＳｉ、Ｐ、Ｆｅなど）が不可避的な不純物として含まれている。

【００１１】ここで、Ａｇ濃度を０．０５～２．０ｗｔ％としたのは、Ａｇの添加によって耐熱性が向上して引張強度が改善されるものの、０．０５ｗｔ％未満では、３５ｋｇｆ／ｍｍ２　以上の高い引張強度が得られなかったからであり、また２．０ｗｔ％を越えると、伸線性が悪化して極細線に伸線する際に断線し易いなどの問題が生じるようになるからである。

【００１２】さらに、このようなＡｇ濃度の銅合金線材を用いて、合成エナメルなどの絶縁材料を塗布し、焼き付けて、マグネットワイヤなどの極細線を製造する際には、この銅合金線材に伸線加工率が５０％以上の伸線加工を施す。

【００１３】この伸線加工は、必要により冷却手段を用いて、常温（２５℃）程度の所謂冷間で行い、しかも、その伸線加工率は５０％以上となるようにする。ここで、伸線加工率が５０％以上ということは、伸線前の線材端面積が伸線後の伸びによって５０％以下に減面される加工率のことをいう。この伸線加工率を５０％以上としたのは、５０％未満では加工硬化による引張強度の向上が小さく、不十分であるため、この値を５０％以上とすることによって、伸線加工の段階で、先ず所定の引張強度の向上を図ったものである。

【００１４】次に、この伸線された銅合金線材に２００～４００℃の加熱下で、合成エナメルなどの絶縁材料を塗布し、焼き付ける。これによって、目的とする導体部の引張強度が３５ｋｇｆ／ｍｍ２　以上の高い強度を有する極細線が得られる。ここで、導体部の引張強度とは、合成エナメルなどの絶縁被覆層部分を剥離した状態における銅合金線材部分の引張強度をいう。

【００１５】この塗布、焼き付け工程で、加熱温度を２００～４００℃の範囲としたのは、加熱温度が２００℃未満では、温度が低過ぎて絶縁材料の線材表面への均一な塗布が確保し難くなるからである。また、逆に４００

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℃を越えて温度が高過ぎると、銅合金線材自体が軟化して引張強度が低下し、３５ｋｇｆ／ｍｍ２　以上の高い引張強度が得られなくなるからである。

【００１６】実施例

先ず、表１～２に示すように、それぞれＡｇ濃度の異なる直径８ｍｍの複数の荒引き銅合金線材（実施例１～５、比較例１～５）を連続鋳造装置で製造し、最終的に直径０．０２ｍｍまで伸線した。この間途中の線径段階において３００～４００℃の温度で複数回の中間焼鈍を行った。

【００１７】そして、最終の中間焼鈍の後、表１～２に示すような伸線加工率に従って、最後の伸線加工（直径０．０５ｍｍから直径０．０２ｍｍまでの伸線加工）を行い、次に、上記各銅合金線材を、線速１５０ｍ／ｍｉｎで走行させ、表１～２に示すような加熱温度下で、合成エナメル（ワニスなど）の絶縁材料を塗布し、焼付けて、各極細線を得た。

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【００１８】これらの各極細線について、導体部の引張強度と伸線性とを測定し、その結果を、表１～２に併記した。ここで、引張強度は、絶縁被覆層部分を剥離した状態の銅合金線材部分を引張試験機にセットして行った。伸線性については、直径０．０５ｍｍから直径０．０２ｍｍまでの伸線を連続ストリップ伸線機で行い、その際の１０Ｋｇ当たりの断線回数が１０回以下のものを合格（○）とし、１０回を越えるものを不合格（×）として評価した。

【００１９】

【表１】

	実施例				
No.	1	2	3	4	5
Ａｇ濃度（ｗｔ％）	0.56	0.075	1.8	0.075	0.075
伸線加工率（％）	99	99	99	99	56
塗布、焼付け温度（℃）	250	250	250	380	380
引張強度（Kgf/mm²）	58	49	62	38	36
伸線性	○	○	○	○	○

【００２０】

【表２】

	比較例				
No.	1	2	3	4	5
Ａｇ濃度（ｗｔ％）	0.03	2.2	0.56	0.56	0.0008
伸線加工率（％）	99	99	99	47	99
塗布、焼付け温度（℃）	250	250	450	250	250
引張強度（Kgf/mm²）	29	64	33	33	27
伸線性	○	×	○	○	○

【００２１】上記表１から、本発明に係る極細線（実施例１～５）の場合、いずれも導体部の引張強度が３５ｋｇｆ／ｍｍ２　以上で高い強度が得られると共に、伸線性についても、いずれもが合格（○）であった。

【００２２】これに対して、Ａｇ濃度（０．０３ｗｔ％）が本発明の条件より低過ぎる比較例１の場合には、焼付け後の導体部の引張強度が２９ｋｇｆ／ｍｍ２　で低かった。Ａｇ濃度（２．２ｗｔ％）が本発明の条件より高過ぎる比較例２の場合には、焼付け後の導体部の引張強度は６４ｋｇｆ／ｍｍ２　で高いものの、伸線性が不合格（×）であった。塗布、焼付け時の温度（４５０℃）が本発明の条件より高過ぎる比較例３の場合には、焼付け後の導体部の引張強度が３３ｋｇｆ／ｍｍ２　で低かった。伸線加工率（４７％）が本発明の条件より小

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さ過ぎる比較例４の場合には、焼付け後の導体部の引張強度が３３ｋｇｆ／ｍｍ２　で低かった。Ａｇ濃度（０．０００８ｗｔ％）が低過ぎてほぼ純銅に近い比較例５の場合にも、焼付け後の導体部の引張強度は２７ｋｇｆ／ｍｍ２　で低かった。

【００２３】

【発明の効果】以上の説明から明らかなように、本発明

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に係る極細線及びその製造方法によれば、例えば直径が０．１ｍｍ以下の極めて細い銅合金線材からなるものであって、かつ導体部の引張強度が３５ｋｇｆ／ｍｍ２以上の高い引張強度を有する優れた線材が得られる。これを、マグネットワイヤなどとして用いれば、電子機器の小型化、軽量化を大幅に促進することができる。

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(72)Inventor : ICHIKAWA MASATERU
SAWAMOTO TAKEHITO
SUGIYAMA SHUICHI

I) EXTRA-THIN WIRE AND ITS PRODUCTION

')Abstract:
:OBLEM TO BE SOLVED: To provide a method for producing an extra-thin wire having high strength of ≥ kgf/mm2 tensiles strength and used as a magnet wire or the like.
)LUTION: A copper alloy wire rod in which the concn. of Ag is controlled to 0.05 to 2.0 wt.%, and the ance copper with inevitable impurities is subjected to wire drawing at a wire drawing ratio of ≥50%, and, er that, this wire-drawn copper alloy wire rod is coated with an insulating material under heating at 200 to)°C, which is baked. By this Ag concn. and heating temp. at the time of the coating and baking, an extra- ı wire having high strength of ≥35 kgf/mm2 tensile strength and used as a magnet wire or the like can be :d.

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AIMS

im(s)]
im 1] The extra fine wire which makes Ag concentration 0.05 - 2.0wt%, and is characterized by the bird clapper
1 the copper alloy wire rod whose remainder is Cu.
im 2] The manufacture method of the extra fine wire which Ag concentration is made into 0.05 - 2.0wt%, and the
of wire drawing performs 50% or more of wire drawing to the copper alloy wire rod whose remainder is Cu, and
ies an insulating material under 200-400-degree C heating at this copper alloy wire rod by which the wire drawing
carried out, and is characterized by printing after an appropriate time.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the extra fine wire used as magnet wires, such as electronic equipment, etc., and its manufacture method.
[0002]
[Description of the Prior Art] Narrow diameter-ization is increasingly demanded also for the magnet wire (coil) used for this with the miniaturization of electronic equipment, and lightweight-izing in recent years. However, the fracture tension of a wire rod becomes small, so that the cross section of a wire rod becomes small. For this reason, if the extra fine wire used as a magnet wire, especially a diameter (phi) are in a thing 0.1mm or less, it is required that it should have high tensile strength.
[0003] Usually, as a narrow diameter magnet wire, after carrying out wire drawing of the copper wire to predetermined size, the synthetic enameled wire which made various insulating materials apply, bake and cover with an elevated temperature is used.
[0004] on the other hand, the same of copper wire is said of a metal wire besides (--) and by carrying out wire drawing work hardening is carried out and it comes to have high tensile strength In using copper wire as conductors, such as an electric wire, it is making it obtain required tensile strength in many cases using the property by this wire drawing.
[0005]
[Problem(s) to be Solved by the Invention] However, also under the temperature between about 200-300 degrees C, a metal texture recrystallizes and the copper wire by which work hardening was carried out has the property to soften.
[0006] for this reason -- above -- as a magnet wire -- copper wire -- using -- up to predetermined size -- wire drawing also carrying out -- when an insulating material was applied and printed at an elevated temperature and it considered a a synthetic enameled wire etc. after that, usually, application of an insulating material and baking needed to be performed at the elevated temperature of 200 degrees C or more, copper wire became soft by high temperature processing at the time of this insulating material application, and there was a problem that tensile strength will fall
[0007] that by which this invention was made in view of such a conventional trouble -- it is -- alloy composition of a wire rod, and the various examination about the manufacture method -- carrying out -- a conductor -- the tensile strength of the section -- 35kgf/mm2 the extra fine wire and its manufacture methods for [which has the above high intensity] magnet wires -- it is going to provide -- it is a thing
[0008]
[Means for Solving the Problem] this invention according to claim 1 makes Ag concentration 0.05 - 2.0wt%, and is in the extra fine wire which the remainder becomes from the copper alloy wire rod which is Cu.
[0009] Ag concentration is made into 0.05 - 2.0wt%, the rate of wire drawing performs 50% or more of wire drawing the copper alloy wire rod whose remainder is Cu, and this invention according to claim 2 is in the manufacture method of the extra fine wire which applies and prints an insulating material on this copper alloy wire rod by which the wire drawing was carried out under 200-400-degree C heating after an appropriate time.
[0010]
[Embodiments of the Invention] In the extra fine wire of this invention, in order to prevent softening of the wire rod at the time of high temperature processing at the time of applying and printing an insulating material under the elevated temperature of 200 degrees C or more, Ag is added in copper (Cu), it considers as a copper alloy wire rod, and the Ag concentration is made into 0.05 - 2.0wt%. In addition, in this copper alloy wire rod, the impurities (for example, Si, P Fe, etc.) of the minute amount which cannot usually be removed in process besides Ag are contained as an unescapable impurity.
[0011] Here, less than [0.05wt%], it is 2 to have made Ag concentration into 0.05 - 2.0wt% 35 kgf/mm, although

nal resistance improves and tensile strength is improved by addition of Ag. It is because the above high tensile gth was not obtained, and is because the problem of being easy to disconnect in case wire drawing nature gets e and a wire drawing is carried out to an extra fine wire will come to arise if 2.0wt(s)% is exceeded.

2] Furthermore, in case insulating materials, such as a synthetic enamel, are applied and printed using the copper wire rod of such Ag concentration and extra fine wires, such as a magnet wire, are manufactured, the rate of wire ing performs 50% or more of wire drawing to this copper alloy wire rod.

3] This wire drawing is performed between the so-called colds about ordinary temperature (25 degrees C) using a ing means as occasion demands, and it is made for the rate of wire drawing to become 50% or more moreover. , 50% or more says the thing of the working ratio by which the reduction of area of the wire rod end-face product ont of a wire drawing is made 50% or less by the elongation after a wire drawing in the rate of wire drawing. At than 50%, having made this rate of wire drawing into 50% or more has the small improvement in the tensile gth by work hardening, and since it is inadequate, by making this value into 50% or more, it is the stage of wire ing and aims at improvement in predetermined tensile strength first.

4] Next, insulating materials, such as a synthetic enamel, are applied and printed on this copper alloy wire rod by h the wire drawing was carried out under 200-400-degree C heating. the conductor made into the purpose by this -- ensile strength of the section -- 35kgf/mm2 The extra fine wire which has the above high intensity is obtained. here conductor -- the tensile strength of the section means the tensile strength of the copper alloy wire rod portion in the where parts for a pre-insulation layer, such as a synthetic enamel, were exfoliated

5] Heating temperature was made into the range of 200-400 degrees C at this application and the baking process use heating temperature of temperature was too low at less than 200 degrees C and it was hard coming to secure a rm application on the wire rod front face of an insulating material. Moreover, conversely, exceeding 400 degrees hen temperature is too high, the copper alloy wire rod itself becomes soft, tensile strength falls, and it is 2 35 nm. It is because the above high tensile strength is no longer obtained.

6] As shown in example point ** and Tables 1-2, two or more skimming copper alloy wire rods (examples 1-5, nples 1-5 of comparison) with a diameter of 8mm with which Ag concentration differs, respectively were ufactured with continuous casting equipment, and, finally the wire drawing was carried out to the diameter of mm. In the intermediate wire-size stage, intermediate annealing of multiple times was performed at the temperature 00-400 degrees C in the meantime.

7] And according to the rate of wire drawing as shown in Tables 1-2, the last wire drawing (wire drawing from the ieter of 0.05mm to the diameter of 0.02mm) was performed after the last intermediate annealing, next the lating material of synthetic enamels (varnish etc.) was applied and baked under heating temperature as is run each e-mentioned copper alloy wire rod by linear velocity 150 m/min and shows it in Tables 1-2, and each extra fine was obtained.

8] each of these extra fine wires -- a conductor -- the tensile strength and wire drawing nature of the section were sured, and the result was written together to Tables 1-2 Here, tensile strength set to the tension tester the copper wire rod portion in the state where a part for a pre-insulation layer was exfoliated, and performed it. About wire ing nature, the wire drawing from the diameter of 0.05mm to the diameter of 0.02mm was performed by the inuation strip wire drawing machine, the number of times of an open circuit per 10kg in that case considered 10 or times of things as success (O), and the thing exceeding 10 times was evaluated as rejection (x).

9]

le 1]

	実施例				
	1	2	3	4	5
濃度 (wt%)	0.56	0.075	1.8	0.075	0.075
加工率 (%)	99	99	99	99	56
焼付け温度 (℃)	250	250	250	380	380
強度 (kgf/mm²)	58	49	62	38	36
性	○	○	○	○	○

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)20]
able 2]

	比較例				
	1	2	3	4	5
g濃度 (wt%)	0.03	2.2	0.56	0.56	0.0008
線加工率 (%)	99	99	99	47	99
布、焼付け温度 (℃)	250	250	450	250	250
張強度 (Kgf/mm²)	29	64	33	33	27
線性	○	×	○	○	○

)21] the case of the extra fine wire (examples 1-5) which starts this invention from the above-mentioned table 1 -- / -- a conductor -- the tensile strength of the section -- 35kgf/mm2 while high intensity is obtained above -- wire .wing nature -- any -- although -- it was success (O)
)22] on the other hand -- the case of the example 1 of comparison which is too lower than the conditions of this ention -- the conductor after printing -- the tensile strength of the section -- 29kgf/mm2 It was low. the case of the mple 2 of comparison which is too higher than the conditions of this invention -- the conductor after printing -- the sile strength of the section -- 64kgf/mm2 although it is high -- wire drawing nature -- a rejection -- it was (x) the e of the example 3 of comparison which is too higher than the conditions of this invention -- the conductor after nting -- the tensile strength of the section -- 33kgf/mm2 It was low. the case of the example 4 of comparison which oo smaller than the conditions of this invention -- the conductor after printing -- the tensile strength of the section -- cgf/mm2 It was low. Ag concentration (0.0008wt%) is low -- elapsing -- the case of the example 5 of comparison ost near a pure copper -- the conductor after printing -- the tensile strength of the section -- 27kgf/mm2 It was low.
23]
fect of the Invention] according to the extra fine wire which starts this invention so that clearly from the above lanation, and its manufacture method -- a diameter -- the thing 0.1mm or less which consists of a narrow copper y wire rod extremely -- it is -- and a conductor -- the tensile strength of the section -- 35kgf/mm2 The outstanding e rod which has the above high tensile strength is obtained. If this is used as a magnet wire etc., the miniaturization electronic equipment and lightweight-ization can be promoted sharply.

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the drawings, any words are not translated.

CHNICAL FIELD

e technical field to which invention belongs] this invention relates to the extra fine wire used as magnet wires, such lectronic equipment, etc., and its manufacture method.

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ɔR ART

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scription of the Prior Art] Narrow diameter-ization is increasingly demanded also for the magnet wire (coil) used his with the miniaturization of electronic equipment, and lightweight-izing in recent years. However, the fracture on of a wire rod becomes small, so that the cross section of a wire rod becomes small. For this reason, if the extra wire used as a magnet wire, especially a diameter (phi) are in a thing 0.1mm or less, it is required that it should high tensile strength.

3] Usually, as a narrow diameter magnet wire, after carrying out wire drawing of the copper wire to predetermined the synthetic enameled wire which made various insulating materials apply, bake and cover with an elevated erature is used.

4] on the other hand, the same of copper wire is said of a metal wire besides (--) and by carrying out wire drawing, hardening is carried out and it comes to have high tensile strength In using copper wire as conductors, such as an ric wire, it is making it obtain required tensile strength in many cases using the property by this wire drawing.

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FECT OF THE INVENTION

fect of the Invention] according to the extra fine wire which starts this invention so that clearly from the above
planation, and its manufacture method -- a diameter -- the thing 0.1mm or less which consists of a narrow copper
oy wire rod extremely -- it is -- and a conductor -- the tensile strength of the section -- 35kgf/mm2 The outstanding
e rod which has the above high tensile strength is obtained. If this is used as a magnet wire etc., the miniaturization
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HNICAL PROBLEM

)lem(s) to be Solved by the Invention] However, also under the temperature between about 200-300 degrees C, a l texture recrystallizes and the copper wire by which work hardening was carried out has the property to soften. 5] for this reason -- above -- as a magnet wire -- copper wire -- using -- up to predetermined size -- wire drawing -- carrying out -- when an insulating material was applied and printed at an elevated temperature and it considered as thetic enameled wire etc. after that, usually, application of an insulating material and baking needed to be ırmed at the elevated temperature of 200 degrees C or more, copper wire became soft by high temperature ssing at the time of this insulating material application, and there was a problem that tensile strength will fall 7] that by which this invention was made in view of such a conventional trouble -- it is -- alloy composition of a rod, and the various examination about the manufacture method -- carrying out -- a conductor -- the tensile gth of the section -- 35kgf/mm2 the extra fine wire and its manufacture methods for [which has the above high sity] magnet wires -- it is going to provide -- it is a thing

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EANS

leans for Solving the Problem] this invention according to claim 1 makes Ag concentration 0.05 - 2.0wt%, and is in
e extra fine wire which the remainder becomes from the copper alloy wire rod which is Cu.
009] Ag concentration is made into 0.05 - 2.0wt%, the rate of wire drawing performs 50% or more of wire drawing to
e copper alloy wire rod whose remainder is Cu, and this invention according to claim 2 is in the manufacture method
the extra fine wire which applies and prints an insulating material on this copper alloy wire rod by which the wire
awing was carried out under 200-400-degree C heating after an appropriate time.
010]
mbodiments of the Invention] In the extra fine wire of this invention, in order to prevent softening of the wire rod at
e time of high temperature processing at the time of applying and printing an insulating material under the elevated
nperature of 200 degrees C or more, Ag is added in copper (Cu), it considers as a copper alloy wire rod, and the Ag
ncentration is made into 0.05 - 2.0wt%. In addition, in this copper alloy wire rod, the impurities (for example, Si, P,
, etc.) of the minute amount which cannot usually be removed in process besides Ag are contained as an unescapable
purity.
011] Here, less than [0.05wt%], it is 2 to have made Ag concentration into 0.05 - 2.0wt% 35 kgf/mm, although
ermal resistance improves and tensile strength is improved by addition of Ag. It is because the above high tensile
ength was not obtained, and is because the problem of being easy to disconnect in case wire drawing nature gets
orse and a wire drawing is carried out to an extra fine wire will come to arise if 2.0wt(s)% is exceeded.
012] Furthermore, in case insulating materials, such as a synthetic enamel, are applied and printed using the copper
oy wire rod of such Ag concentration and extra fine wires, such as a magnet wire, are manufactured, the rate of wire
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013] This wire drawing is performed between the so-called colds about ordinary temperature (25 degrees C) using a
oling means as occasion demands, and it is made for the rate of wire drawing to become 50% or more moreover.
ere, 50% or more says the thing of the working ratio by which the reduction of area of the wire rod end-face product
front of a wire drawing is made 50% or less by the elongation after a wire drawing in the rate of wire drawing. At
s than 50%, having made this rate of wire drawing into 50% or more has the small improvement in the tensile
ength by work hardening, and since it is inadequate, by making this value into 50% or more, it is the stage of wire
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014] Next, insulating materials, such as a synthetic enamel, are applied and printed on this copper alloy wire rod by
nich the wire drawing was carried out under 200-400-degree C heating. the conductor made into the purpose by this --
e tensile strength of the section -- 35kgf/mm2 The extra fine wire which has the above high intensity is obtained. here
a conductor -- the tensile strength of the section means the tensile strength of the copper alloy wire rod portion in the
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015] Heating temperature was made into the range of 200-400 degrees C at this application and the baking process
cause heating temperature of temperature was too low at less than 200 degrees C and it was hard coming to secure a
iform application on the wire rod front face of an insulating material. Moreover, conversely, exceeding 400 degrees
when temperature is too high, the copper alloy wire rod itself becomes soft, tensile strength falls, and it is 2 35
f/mm. It is because the above high tensile strength is no longer obtained.
016] As shown in example point ** and Tables 1-2, two or more skimming copper alloy wire rods (examples 1-5,
amples 1-5 of comparison) with a diameter of 8mm with which Ag concentration differs, respectively were
anufactured with continuous casting equipment, and, finally the wire drawing was carried out to the diameter of
02mm. In the intermediate wire-size stage, intermediate annealing of multiple times was performed at the temperature
300-400 degrees C in the meantime.
017] And according to the rate of wire drawing as shown in Tables 1-2, the last wire drawing (wire drawing from the

ıeter of 0.05mm to the diameter of 0.02mm) was performed after the last intermediate annealing, next the lating material of synthetic enamels (varnish etc.) was applied and baked under heating temperature as is run each /e-mentioned copper alloy wire rod by linear velocity 150 m/min and shows it in Tables 1-2, and each extra fine : was obtained.

.8] each of these extra fine wires -- a conductor -- the tensile strength and wire drawing nature of the section were sured, and the result was written together to Tables 1-2 Here, tensile strength set to the tension tester the copper y wire rod portion in the state where a part for a pre-insulation layer was exfoliated, and performed it. About wire ving nature, the wire drawing from the diameter of 0.05mm to the diameter of 0.02mm was performed by the inuation strip wire drawing machine, the number of times of an open circuit per 10kg in that case considered 10 or times of things as success (O), and the thing exceeding 10 times was evaluated as rejection (x).

.9]

)le 1]

	実施例				
	1	2	3	4	5
濃度 (wt%)	0.56	0.075	1.8	0.075	0.075
加工率 (%)	99	99	99	99	56
焼付け温度 (℃)	250	250	250	380	380
強度 (Kgf/mm²)	58	49	62	38	36
性	○	○	○	○	○

!0]

)le 2]

	比較例				
	1	2	3	4	5
濃度 (wt%)	0.03	2.2	0.56	0.56	0.0008
加工率 (%)	99	99	99	47	99
焼付け温度 (℃)	250	250	450	250	250
強度 (Kgf/mm²)	29	64	33	33	27
性	○	×	○	○	○

21] the case of the extra fine wire (examples 1-5) which starts this invention from the above-mentioned table 1 -- -- a conductor -- the tensile strength of the section -- 35kgf/mm2 while high intensity is obtained above -- wire ving nature -- any -- although -- it was success (O)

22] on the other hand -- the case of the example 1 of comparison which is too lower than the conditions of this ention -- the conductor after printing -- the tensile strength of the section -- 29kgf/mm2 It was low. the case of the mple 2 of comparison which is too higher than the conditions of this invention -- the conductor after printing -- the sile strength of the section -- 64kgf/mm2 although it is high -- wire drawing nature -- a rejection -- it was (x) the e of the example 3 of comparison which is too higher than the conditions of this invention -- the conductor after ıting -- the tensile strength of the section -- 33kgf/mm2 It was low. the case of the example 4 of comparison which)o smaller than the conditions of this invention -- the conductor after printing -- the tensile strength of the section -- gf/mm2 It was low. Ag concentration (0.0008wt%) is low -- elapsing -- the case of the example 5 of comparison

ost near a pure copper -- the conductor after printing -- the tensile strength of the section -- 27kgf/mm2 It was low.

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